

CLAIMS

What is claimed is:

1 1. A self-priming IV-solution delivery system for intravenous delivery of a
2 solution from a container to a patient when the container is disposed at a height above the
3 patient, comprising:

4 a coupling assembly having an input and an output, said input configured for
5 coupling to the container to provide flow of the solution through the coupling assembly to
6 the output;

7 a drip chamber having a top wall, a bottom wall, a side wall, an input and an
8 output and coupled, at its input, to said coupling assembly output to receive solution drops
9 formed from the flow of the solution for forming a reservoir defined between said bottom
10 wall and side wall, said drip chamber side wall having an opening located at a height
11 between said top wall and said bottom wall, and a vent plug covering said opening, said
12 vent plug allowing air contained in said drip chamber which becomes displaced upon
13 formation of the reservoir to escape from said drip chamber through said vent plug; and

14 a patient conduit coupled to said drip chamber output and having a
15 termination end attachable to an intravenous needle of the patient for receiving a flow of
16 solution from the reservoir, said patient conduit having a flow restriction device to restrict
17 the flow of air and liquid in the patient conduit to allow the reservoir to attain a level at least
18 equal to the height of said vent plug while air in the patient conduit is expelled from said
19 termination end, wherein wetting of said vent plug by the reservoir prevents entry of air

20 through said vent plug to said drip chamber and prevents the exit of solution from said drip
21 chamber through said vent plug.

1 2. The system of claim 1, wherein said flow restriction device
2 comprises a termination end cap having a vent formed therein, said end cap configured
3 for attachment to said termination end.

1 3. The system of claim 2, wherein said end cap comprises a
2 termination end vent plug for allowing air present in said patient conduit to pass through
3 said end cap vent and for preventing leakage of medicament from said end cap.

1 4. The system of claim 3, wherein said termination end vent plug
2 comprises a hydrophilic porous material.

1 5. The system of claim 2, wherein said flow restriction device further
2 comprises a flow restriction device positioned on said patient conduit for selectively
3 closing said patient conduit to isolate the patient from said drip chamber.

1 6. The system of claim 1, further comprising a flexible conduit coupled
2 between said coupling assembly output and said drip chamber input and having a
3 length for separating a relative distance between said drip chamber and said coupling
4 assembly so that said drip chamber is positioned in close proximity to the patient to
5 provide observation of said drip chamber, and to provide manipulation of said drip
6 chamber with, at most, minimal disturbance of said coupling assembly.

1 7. The system of claim 1, wherein a drip orifice is located in said drip
2 chamber top wall for forming the solution drops.

1 8. The system of claim 1, wherein the height of said side wall opening
2 coincides with a reservoir level occupying approximately 1/3 of the total volume defined
3 in said drip chamber.

1 9. The system of claim 1, wherein said vent plug comprises an
2 absorbing material and a housing connected to said side wall opening and defining a
3 cavity for receiving a formation of said absorbent material, and wherein said absorbing
4 material comprises a super-absorbent polymer which expands in response to wetting by
5 the reservoir.

1 10. The system of claim 9, wherein said vent plug further comprises an
2 anti-bacterial agent.

1 11. The system of claim 1, wherein said vent plug comprises a housing
2 connected to said side wall opening and defining a cavity having a first end in
3 communication with said drip chamber, and a second end in communication with a
4 surrounding atmosphere, said cavity receiving an amount of an absorbing material
5 which expands in response to wetting by the reservoir, said absorbing material
6 comprising a granular super-absorbent polymer, and further comprising a filter disposed
7 at said first end and a venting membrane disposed at said second end.

1 12. The system of claim 11, wherein said vent plug further comprises
2 an anti-bacterial agent.

1 13. The system of claim 1, wherein said vent plug comprises a cannula
2 defining a cavity, and wherein an absorbing material which expands in response to
3 wetting by the reservoir comprises an amount of super-absorbent polymer material
4 disposed in said cavity, said cannula dimensioned for securement within said side wall
5 opening and having a first end in communication with said drip chamber, and a second
6 end in communication with a surrounding atmosphere.

1 14. The system of claim 1, wherein said vent plug comprises a rigid
2 core of impervious material surrounded by said absorbing material which expands in
3 response to wetting by the reservoir.

1 15. The system of claim 9, wherein said housing cavity has a
2 trapezoidal cross-section and wherein said formation of said super-absorbent polymer
3 material substantially occupies said housing cavity, said housing further comprising an
4 obstruction positioned at a housing end in communication with said drip chamber for
5 maintaining said formation in said housing cavity.

1 16. The system of claim 1, wherein said coupling member comprises a
2 piercing member.

1 17. The system of claim 16, wherein said piercing member defines a
2 closable venting conduit and a liquid conduit.

1 18. The system of claim 17, wherein said coupling assembly further
2 comprises a funnel portion for directing solution from the container to said drip chamber.

1 19. The system of claim 18, wherein said coupling assembly further
2 comprises a membrane disposed within said funnel portion for preventing air trapped
3 above said membrane from entering said drip chamber once the container is empty.

1 20. The system of claim 19, wherein said coupling assembly further
2 comprises an air filter for interfacing an area above said membrane with a surrounding
3 atmosphere to allow air which may be trapped in said coupling member above said
4 membrane to escape to the surrounding atmosphere.

1 21. The system of claim 1, wherein said coupling member comprises
2 an output end defining a drip orifice for forming the solution drops.

1 22. The system of claim 1, further comprising a splash guard
2 connected to said side wall above said vent plug in an interior of said drip chamber and
3 extending across said vent plug.

1 23. The system of claim 1, further comprising an outer shield
2 connected to said side wall above said vent plug in an exterior of said drip chamber and
3 extending across said vent plug.

1 24. In an IV-solution delivery system for intravenous delivery of a solution
2 from a container to a patient when the container is disposed at a height above the patient,

3 having a coupling assembly with an input and an output, said input configured for coupling
4 to the container to provide flow of the solution through the coupling assembly to the output,
5 a drip chamber having a top wall, a bottom wall, a side wall, an input and an output and
6 coupled, at its output, to said coupling assembly to receive solution drops formed from the
7 flow of the solution for forming a reservoir defined between said bottom wall and side wall,
8 and a patient conduit coupled to said drip chamber output and having a termination end
9 attachable to an intravenous needle of the patient for receiving a flow of solution from the
10 reservoir, the improvement providing a self-priming of the solution delivery system and
11 comprising:

12 an opening formed in said drip chamber side wall at a height between said
13 top wall and said bottom wall, and a vent plug covering said opening, said vent plug
14 comprised of a material for allowing air contained in said drip chamber which becomes
15 displaced upon formation of the reservoir to escape from said drip chamber through said
16 vent plug; and

17 said patient conduit having a flow restriction device to restrict the flow of air
18 and liquid in the patient conduit to allow the reservoir to attain a minimum level at least
19 equal to the height of said vent plug while air in the patient conduit is expelled from said
20 termination end, wherein wetting of said vent plug by the reservoir prevents entry of air
21 through said vent plug to said drip chamber and prevents the exit of solution from said drip
22 chamber through said vent plug.

1 25. The improvement of claim 24, wherein said vent plug comprises a
2 super-absorbent polymer material which swells in response to wetting by the reservoir.

1 26. The system of claim 25, wherein said vent plug comprises a
2 housing connected to said side wall opening and defining a cavity for receiving a
3 formation of said super-absorbent polymer material.

1 27. The system of claim 25, wherein said vent plug comprises a
2 housing connected to said side wall opening and defining a cavity having a first end in
3 communication with said drip chamber, and a second end in communication with a
4 surrounding atmosphere, said cavity receiving an amount of said super-absorbent
5 polymer material in a granular form, and further comprising a filter disposed at said first
6 end and a venting membrane disposed at said second end.

1 28. The system of claim 25, wherein said vent plug comprises a
2 cannula defining a cavity and containing an amount of said super-absorbent polymer
3 material therein, said cannula dimensioned for securement within said side wall opening
4 and having a first end in communication with said drip chamber, and a second end in
5 communication with a surrounding atmosphere.

1 29. The system of claim 24, wherein said vent plug comprises a rigid
2 core of impervious material surrounded by a layer of super-absorbent polymer material.

1 30. The system of claim 26, wherein said housing cavity has a
2 trapezoidal cross-section and wherein said formation of super-absorbent polymer
3 material substantially occupies said housing cavity, said housing further comprising an

4 obstruction positioned at a housing end in communication with said drip chamber for
5 maintaining said formation in said housing cavity.

1 31. A drip chamber for use in a self-priming solution delivery system for
2 intravenous delivery of a solution from a container to a patient, the solution delivery system
3 including a coupling assembly having an input and an output and configured, at its input,
4 for coupling to the container to provide flow of the solution through the coupling assembly
5 output, and a patient conduit line for providing solution from the container to the patient,
6 said drip chamber comprising:

7 a top wall, a bottom wall, a side wall, an input and an output and coupled, at
8 its input, to the coupling assembly output to receive solution drops formed from the flow of
9 the solution for forming a reservoir defined between said bottom wall and side wall, said
10 drip chamber side wall having an opening located at a height between said top wall and
11 said bottom wall, and a vent plug covering said opening, said vent plug allowing air
12 contained in said drip chamber which becomes displaced upon formation of the reservoir
13 to escape from said drip chamber through said vent plug and preventing air from entering
14 said drip chamber through said vent plug and solution from exiting said drip chamber
15 through said vent plug upon wetting of said vent plug by said reservoir.

1 32. The drip chamber of claim 31, wherein said vent plug comprises an
2 absorbing material disposed in said opening.

1 33. The drip chamber of claim 31, wherein said vent plug is configured as
2 a band of material having a section comprising an absorbing material, said vent plug being

3 disposed about said drip chamber side wall so that said absorbing material is positioned
4 over said opening for covering said opening with said absorbing material.

1 34. The drip chamber of claim 33, wherein said absorbing material
2 comprises a super-absorbent polymer which expands in response to wetting by said
3 reservoir.

1 35. The drip chamber of claim 32, wherein the height of said side wall
2 opening coincides with a reservoir level occupying approximately 1/3 of the total volume
3 defined in said drip chamber.

1 36. The drip chamber of claim 32, wherein said vent plug comprises a
2 housing connected to said side wall opening and defining a cavity for receiving a
3 formation of said absorbing material, and wherein said absorbing material comprises a
4 super-absorbent polymer which expands in response to wetting by the reservoir.

1 37. The drip chamber of claim 32, wherein said vent plug comprises a
2 housing connected to said side wall opening and defining a cavity having a first end in
3 communication with said drip chamber, and a second end in communication with a
4 surrounding atmosphere, said cavity receiving an amount of an absorbing material
5 which expands in response to wetting by the reservoir, said absorbing material
6 comprising a granular super-absorbent polymer, said vent plug further comprising a
7 filter disposed at said first end and a venting membrane disposed at said second end.

1 38. The drip chamber of claim 37, wherein said housing cavity has a
2 trapezoidal cross-section and wherein said formation of said super-absorbent polymer
3 material substantially occupies said housing cavity, said housing further comprising an
4 obstruction positioned at a housing end in communication with said drip chamber for
5 maintaining said formation in said housing cavity.

1 39. The drip chamber of claim 32, further comprising an outer shield
2 connected to said side wall above said vent plug in an exterior of said drip chamber and
3 extending across said vent plug.

1 40. A drip chamber for use in a self-priming solution delivery system for
2 intravenous delivery of a solution from a container to a patient, the solution delivery system
3 including a coupling assembly having an input and an output and configured, at its input,
4 for coupling to the container to provide flow of the solution through the coupling assembly
5 output, and a patient conduit line for providing solution from the container to the patient,
6 said drip chamber comprising:

7 a top wall, a bottom wall, a side wall, an input and an output and coupled, at
8 its input, to the coupling assembly output to receive solution drops formed from the flow of
9 the solution for forming a reservoir defined between said bottom wall and side wall, said
10 drip chamber side wall having a first section formed of a first material impervious to the
11 solution and to air for preventing solution exiting said drip chamber through said side wall
12 first section and for preventing air from exiting and entering said drip chamber through said
13 side wall first section, and a second section located at a height between said top wall and

14 said bottom wall and formed of a second material, said second material being pervious to
15 air when said second material is in a dry state to permit air from inside said chamber to
16 escape to an outside environment, said second material being impervious to air and to the
17 solution when said second material is wetted by said reservoir for preventing solution
18 exiting said drip chamber through said side wall second section and for preventing air from
19 exiting and entering said drip chamber through said side wall second section.

1 41. The drip chamber of claim 40, wherein said second material
2 comprises a super-absorbent polymer which expands in response to wetting by said
3 reservoir.

1 42. The drip chamber of claim 40, wherein the height of said side wall
2 second section coincides with a reservoir level occupying approximately 1/3 of the total
3 volume defined in said drip chamber.

1 43. A solution delivery system for intravenous delivery of a solution
2 from a container to a patient, comprising:

3 a coupling assembly having an input and an output, said input configured
4 for coupling to the container to remove solution from the container;

5 a patient conduit for providing the removed solution to a patient;

6 means for regulating a flow rate of solution from said coupling assembly to
7 said patient conduit, said patient conduit coupled at one end to said regulating means
8 and having a termination end; and

9 a termination end cap coupled to said termination end and having a vent
10 for restricting the flow of solution into said patient conduit and allowing air displaced by
11 the flow of solution in said patient conduit to escape through said termination end, said
12 end cap further comprising a termination end vent plug for preventing the escape of
13 solution through said termination end cap upon wetting of said vent plug by the solution.

1 44. The medical delivery system of claim 43, wherein said termination
2 end cap is releasably detachable to said termination end.

1 45. The medical delivery system of claim 43, wherein said termination
2 end cap is releasably detachable to said termination end by a luer connection.

1 46. The solution delivery system of claim 43, wherein said termination
2 end vent plug comprises one of a super-absorbent polymer material and a hydrophobic
3 material.

1 47. The solution delivery system of claim 43, wherein said regulating
2 means comprises a drip chamber.

1 48. The solution delivery system of claim 43, wherein said regulating
2 means comprises an infusion pump.

1 49. A method of intravenous delivery of a solution from a container to a
2 patient, comprising the steps of
3 disposing the container at a height above the patient;

4 attaching a coupling assembly to said container for providing flow of the
5 solution from the container;

6 coupling a drip chamber having a bottom wall, a side wall, an input, an
7 output, an opening in the side wall, and a vent plug disposed over said opening, to said
8 coupling assembly to receive solution drops formed from the flow of the solution;

9 connecting a patient conduit to said drip chamber output;

10 restricting the flow of solution in said patient conduit to a rate below the rate
11 of solution entering said drip chamber to allow a reservoir defined between said bottom
12 wall and side wall to form to a height for wetting said vent plug, said vent plug allowing air
13 contained in said drip chamber which becomes displaced upon formation of the reservoir
14 to escape from said drip chamber through said vent plug;

15 connecting a termination end of said patient conduit to the patient once the
16 vent plug is wet from the reservoir and air is removed from the patient conduit; and

17 discontinuing said restriction step upon wetting of said vent plug by said
18 reservoir and removal of air from said patient conduit.

1 50. The method of claim 49, wherein said restricting step comprises
2 disposing a termination end cap on said termination end, said termination end cap
3 having a vent for allowing air displaced by the flow of solution in said patient conduit to
4 escape through said termination end, said end cap further comprising a termination end
5 vent plug for preventing the escape of solution through said vent upon wetting of said
6 termination end cap plug by the solution.

- 1 51. The method of claim 49, wherein said restricting step comprises
- 2 closing a clamp disposed on said patient conduit.